Cavernous Sinus Dural Fistula Treated by Transvenous Facial Vein Approach

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Summary

We report on the endovascular treatment of the spontaneous indirect dural carotid cavernous sinus type D fistula in a 60-year-old woman, in whom ipsilateral facial, angular and superior ophthalmic veins catheterization was performed to get access to the fistula site for embolization treatment. Approach via the facial vein is helpful after inferior petrosal sinus treatment failure. Although this technique requires caution in the angular vein region it allows a safe and effective treatment of these lesions. 3D rotational digital angiography can obtain more information of the angioarchitecture of the cavernous plexus and venous outflow for the catheter navigation.

Introduction

According to Barrow et Al [1] anatomical–angiographic carotid cavernous sinus fistulas classification, fistulas can be treated by transarterial and/or transvenous endovascular techniques. While most of the dural carotid-cavernous fistulas (DCCFs) are tolerated well and resolve spontaneously, without any other treatment, hyperpressure in the cavernous sinus and superior ophtalmic vein may cause eye damage [2]. The cortical venous drainage increases the risk of intracranial haemorrhage [3]. The initial treatment of the most spontaneous DCCFs cases involves manual jugular-carotid or superior ophtalmic vein compression. The transvenous embolization according to the angioarchitecture situation becomes the method of choice for aggressive DCCFs treatment. Cavernous sinus fistulas are usually treated by the inferior pertrosal sinus (IPS) approach. Many other situations according to the venous drainage and cavernous sinus architecture may be observed. The transvenous route by the facial vein can be used safely in the case of anterior venous drainage through the superior ophtalmic vein (SOV), angular and facial veins [4].

Patient Characteristics

One month before the endovascular therapy, a 60-year-old woman with a 22-year-long history of diabetes mellitus with the oral antidiabetic treatment and hypertension of II-WHO grading was admitted to another hospital for rapid involvement of diplopia and right eyeball protrusion. The patient was suspected of having right ophthalmic vein thrombosis and she was put on the anticoagulation therapy. This was complicated by a rapid progression of the incomplete right abducens and oculomotor nerve, palsy and chemosis. Fourteen days later the patient was referred to our institution, where the CT scan, trans-orbital (TO) duplexdoppler sonography and angiography revealed spontaneous DCCF. At the time of admission to our hospital the patient had right side exophthalmus with the conjunctival injection and chemosis with the "caput medusae" sign, complete palsy of the right abducens nerve and the incomplete of oculomotor nerve with diplopia and right blepharoptosis. There was no loss of the vertical eye movement, no mydriasis and visual disturbance.

The cerebral angiography (figure 1) revealed a Barrow type D - DCCF fed by meningeal branches of ipsilateral and contralateral internal carotid arteries and by multiple meningeal branches of both external carotid arteries. There were no feeding vessels from the vertebral arteries. The DCCF drained from the cavernous sinus into the right SOV, right pterygoid plexus, right angular and facial veins, left inferior petrosal sinus and via the cortical veins. A transcavernous drainage into the right cavernous sinus was observed. The right inferior petrosal sinus was not visible and the drainage into the right IJV could not be detected. The left SOV was not opacified.

The 3D–XRa digital rotational angiography of the right internal carotid artery and the indirect dural cavernous sinus fistula was performed and the 3D angioarchitecture of the cavernous sinus, superior ophthalmic and angular veins was reconstructed after that.

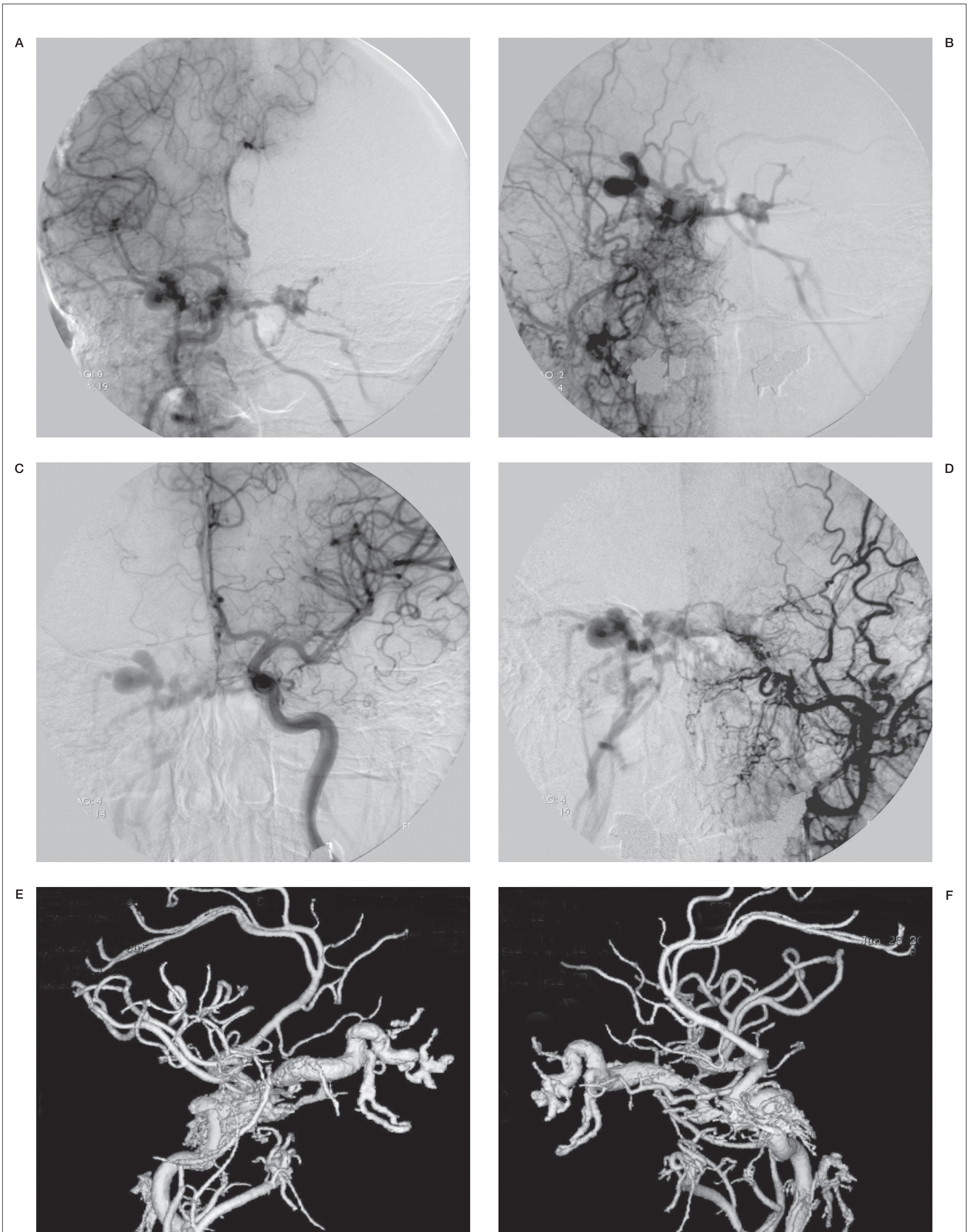
Description of the Technique

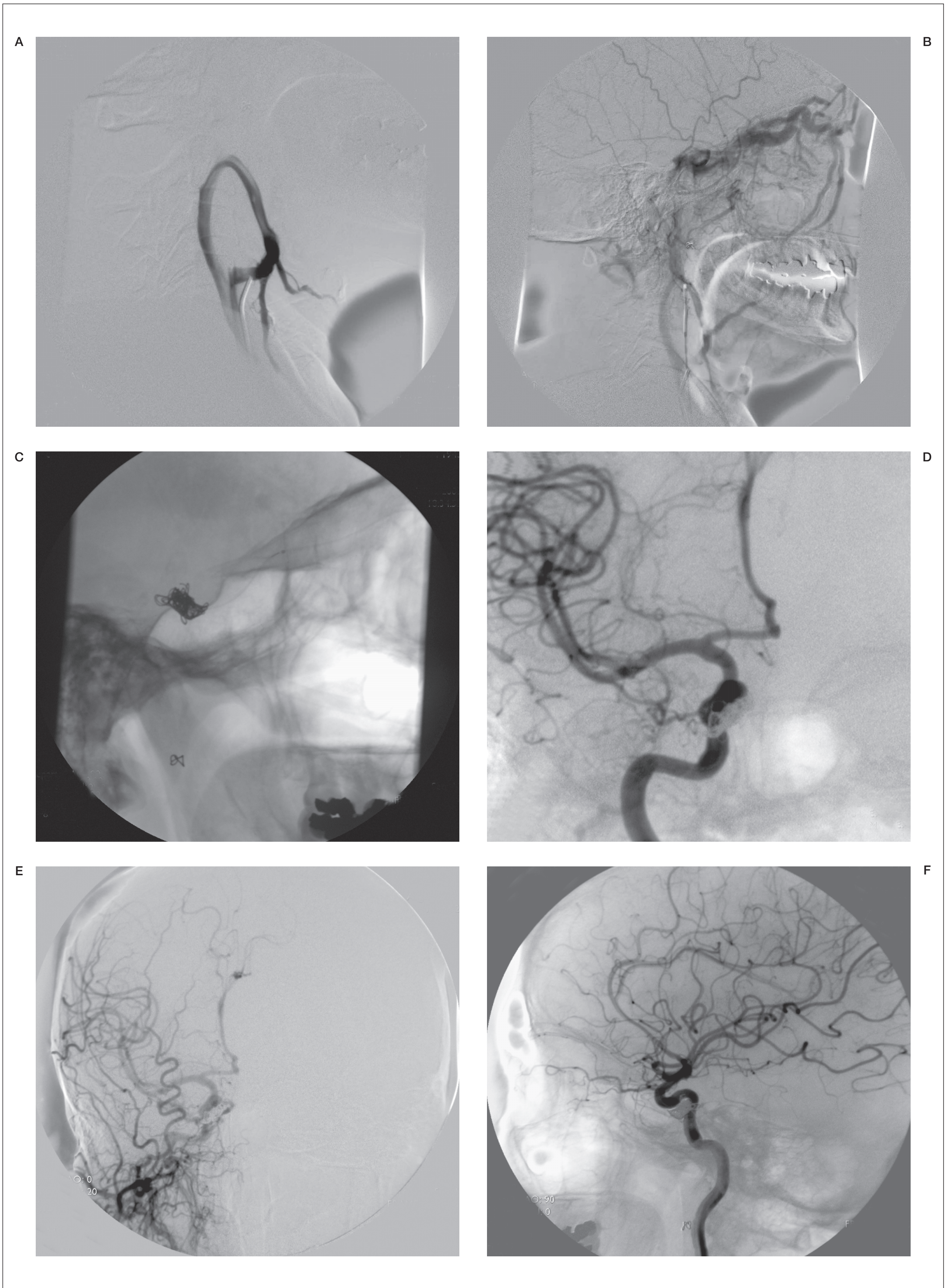
The 5F Terumo (Radiofocus, Tokyo, Japan) sheath was introduced into the right common femoral vein for the venous approach and another 5F Terumo sheath was inserted into the right common femoral artery for right external carotid artery angiography. The patient was under general anesthesia and tracheal intubation. A control angiogram was performed by the 4F Vertebral Aqua - Tempo catheter (Cordis-Endovascular, JJ, Miami,FL). The catheters were put on a continual flushing system and 7500 units of UF–Heparin i.a was administered. At the beginning, the largest dural branch from the right middle meningeal artery (MMA) was embolized through the Microferret catheter by the Tornado DCS-18/4/2 fibred coil (William Cook Europe, Bjaeverskov, Denmark) for the cavernous sinus and the SOV inflow reduction. There was a minimal impact of this embolization on the cavernous sinus fistula drainage. After that we decided to perform cavernous sinus embolization from the transvenous approach (figure 2).

We tried to get access to the inferior petrosal sinus (IPS) with the 5F Envoy (Cordis Endovascular, JJ, Miami, FL) guiding catheter introduced into the right internal jugular vein bulb (IJV) over the hydrophilic 0.035 Terumo guidewire. While performing the external carotid artery angiograms, there was no opacification of the right IPS and no drainage from the IPS into the right IJV either. This approach was unsuccessful and the only visible way to the cavernous sinus was through the right facial, angular and superior ophthalmic veins due to the anterior type of drainage. The 5F guiding catheter was introduced into the right facial vein under road-mapping control. After that the right facial vein was catheterized by the Excelsior microcatheter (Boston Scientific/Target, Fremont,Ca) in conjunction with 0.014/300 and 0.010/200 Transend floppy guidewires (Boston Scientific/ Target, Fremont,Ca). The right angular vein was traversed by a 0.008 Mirage (MTI) microguidewire into the SOV very gently and the microcatheter was then navigated under road-map control into the medial part of the cavernous sinus. The embolization procedure was completed by DCS-18 6/200 (William Cook Europe, Bjaeverskov, Denmark) and 750 mms of 7 GDC-18 coils (Boston Scientific/Target, Fremont, Ca).

The final angiogram of both common carotid arteries was performed with the DCCF exclusion result. The bilateral external and internal carotid arteries control angiogram was performed one month later without the carotid cavernous sinus fistula and the right SOV drainage detection. The neurological and ophthalmological conditions of the patient improved rapidly, the right occular symptoms regressed in four weeks and the patient was symptom free for the following two months.

Figure 1 A) Right ICA late phase angiogram shows DCCF with the right SOV dilatation. B) Right ECA angiogram, DCCF fed by the right MMA dural branches, C) Left ICA angiogram with the transcavernous supply to the DCCF. D) Left MMA dural branches with transcavernous DCCF drainage. E-F) 3D-Angio from lateral and medial view with right SOV and angular veins angioarchitecture.

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Discussion

Both arterial and transvenous endovascular approaches have been used in many cases for DCCF treatment [5,6]. The transvenous route into the cavernous sinus seems to be the safest and the most efficient way for the treatment of these lesions. The treatment through the IPS is the first method of choice at present. Halbach et Al [7] reported 13 cases of DCCS fistula embolization after IPS catheterization. Even if no opacification of the IPS was seen, a successful approach was reported. Five cases of the group of Halbach´s patients did not demonstrate IPS perfusion during the initial angiography.

Mounayer et Al [8] reported a case of successful transvenous embolization via the superior petrosal sinus (SPS) route. Quinones et Al [9] in 13 patients and Berlis et Al [10] in their cases reported a combined technique of microsurgical exposure and endovascular embolization treatment of the SOV. This approach is useful for the patients with IPS thrombosis or facial–angular vein stenosis or occlusion. SOV can be reached by a deep orbital puncture. Benndorf et Al [11] reported this deep puncture in the posterior third of the orbit using a biplane roadmap in the case of the thrombosed proximal part of SOV.

Transvenous approach through the pterygoid plexus was reported by Jahan et Al [12] in the situation when one SOV was completely thrombosed and the other one was partially opacified with no access through the IPS or facial vein. Chun and Tomsick [13] reported successful treatment of the direct carotid cavernous fistula by an ipsilateral pterygoid plexus approach.

The knowledge of angioarchitecture is essential for selecting which venous route should be used in individual cases [14]. 3D reconstruction of the cavernous sinus, SOV, angular vein and facial vein can give more information of the situation. In the case of the anterior fistula drainage the visualization of SOV, angular vein and facial vein under road-map can be used for the retrograde selective facial vein catheterization. In our case the right facial vein route was used for DCCF embolization. This treatment was reported in seven successful cases referred by Biondi A et Al [15]. The facial vein could also be directly punctured under duplex sonography control as shown by Berkman et Al [16] in the situation of no transvenous transfemoral approach. In our case we did not experience any problem during the facial and SOV catheterization, because we used an improved microwire (0.008 Mirage, MTI) for the traversing of the thin angular vein with tortuous roots. This navigation must be performed with a great care. The risk of perforation, damage or potential thrombotic complications were demonstrated in the recent CCFs, in which the venous wall had not been arterialized yet. The transfemoral route through the facial vein seems to be less traumatic than the direct microsurgical or the SOV deep puncture technique. Finally which venous route should be used in an individual case depends on the architecture of the CCF and the clinical conditions of each patient [17-21].

Figure 2 A) Transvenous approach to the right facial vein, 5F Envoy (JJ) guiding catheter. B) Late arterial phase of the right ECA with the right SOV and facial veins. C) Transvenous GDC embolization through the right facial, angular and SOV veins. D-F) Bilateral control angiograms with occlusion of the DCCF.

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